DYNAMIC SEATING SYSTEM
FOR PERSONAL MOBILITY VEHICLE

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CROSS REFERENCE TO RELATED APPLICATIONS

[001] This application is a continuation-in-part of pending application Serial No. 10/403,558 filed May 31, 2003, assigned to the assignee of this application, and incorporated herein by reference.

BACKGROUND OF INVENTION

[002] This invention relates in general to land vehicles and, more particularly, to personal mobility vehicles. Most particularly, this invention relates to a seating system for personal mobility vehicles.

[003] Personal mobility vehicles, such as wheelchairs and strollers, often have a fixed seat consisting of a seating surface and a back frame. The seat and back frames are typically mounted on a base, which, for most personal mobility vehicles, supports two rear drive wheels and two front caster wheels. The personal mobility vehicle can be either manual driven, or power driven, in which case, the drive wheels will be motorized. The seating surface is usually either horizontal or slightly tilted back, with the front edge of the seating surface slightly higher than the rear edge of that surface. If a user sits in the same position in a vehicle for a long period of time, pressure is continuously applied to the tissue on the portion of the user's body (e.g., the buttocks, legs, and/or back) that is bearing the user's weight in that position. Blood circulation to that tissue will be reduced, and ulcers or other problems can result.

[004] To avoid these problems, it is advantageous for people sitting in personal mobility vehicles to shift their body weight from time to time. This is often accomplished by tilting the seat portion of the personal mobility vehicle backwards so

that the user's weight is shifted away from the pressure points on the user's body. Also, the user's weight can be shifted by reclining the back frame. Reclining the seat back frame allows some of the user's weight to be borne by the user's back, thereby reducing the weight on the user's buttocks. Also, reclining the seat back allows the user to open and close the hip angle, thereby enabling the user to assume or be placed in both active and resting positions. This makes it possible for the user to be more comfortable in a multiplicity of activities.

[005] Conventional personal mobility vehicle seating systems are generally rigid. Vehicle users tend to fight against the seating system or feel restricted due to the rigidity. As a result, the personal mobility vehicle is often subjected to damage. It would be advantageous if there could be developed a personal mobility vehicle that does not restrict the user.

SUMMARY OF INVENTION

[006] The present invention is directed towards a dynamic seating system that includes a base, a seat tray, and a biasing element. The seat tray is positioned within the base and mounted for forward and rearward sliding movement with respect to the base. The biasing element is connected relative to the base and the seat tray for biasing the seat tray rearward relative to the base.

[007] Various objects and advantages of this invention will become apparent to those skilled in the art from the following detailed description of the preferred embodiment, when read in light of the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[008] Figure 1 is a schematic perspective view of a personal mobility vehicle adapted with a seating system according to the invention.

[009] Figure 2 is a schematic view in perspective of the seating system according to the invention, with the seat back in a non-reclined condition.

[010] Figure 3 is a schematic view in perspective of the seating system of Figure 2, with the seat back in a reclined condition.

[011] Figure 4 is schematic exploded view in perspective of the seating system of Figure 2.

[012] Figure 5 is a schematic view in perspective of the seating system of Figure 2, with the seat back in a folded condition.

[013] Figure 6 is a schematic rear view in perspective of the seating system of Figure 2.

[014] Figure 7 is a schematic rear view in perspective of the seating system of Figure 2, showing the unlatching of the release block.

[015] Figure 8 is a schematic view of the personal mobility vehicle shown in Figure 1, with the seating system removed.

[016] Figure 9 is an enlarged schematic front view in perspective of a guide of the seating system, with the seat back in a non-reclined condition.

[017] Figure 10 is an enlarged schematic front view in perspective of a guide, with the seat back in a reclined condition.

[018] Figure 11 is an enlarged schematic rear view in perspective of a biasing element of the seating system, with the seat back in a non-reclined condition.

[019] Figure 12 is an enlarged schematic rear view in perspective of the biasing element, with the seat back in a reclined condition.

DETAILED DESCRIPTION

[020] Referring now to the drawings, there is illustrated in Figure 1 a personal mobility vehicle, generally indicated at 10, which may be in the form of a wheelchair, a stroller, or the like. The vehicle comprises a base 12, which is mounted for

movement on front caster wheels 14 and rear wheels 16. The base 12 includes a frame 18, which may include welded or bolted members, some of which may be tubular. The frame 18 may extend upwardly to form a handle 20. A leg support 22 can be provided. The base 12 supports a seating system, generally indicated at 30.

[021] As shown in Figures 2-4, the seating system 30 of the invention may include a seating shell base 32, into which may be nested or positioned an inner seat tray 34. The seating shell base 32 is attached to and supported by the base 12. The inner seat tray 34 is secured to the seating shell base 32 in a manner that allows the inner seat tray 34 to slide forward and rearward with respect to the seating shell base 32. An optional seat tray extension 38 is mounted for attachment to the inner seat tray 34 for the purpose of enabling a length adjustment of the seating system 30 to accommodate growth of the user of the vehicle. Optionally, the seat tray extension 38 can be provided with mounting arms 39 for mounting the leg support 22.

[022] The mounting of the inner seat tray 34 within the seating shell base 32 may be accomplished by slides 37, which are mounted between the inner seat tray 34 and the seating shell base 32 to facilitate guided, sliding movement of the inner seat tray 34 forward and rearward with respect to the seating shell base 32. The slides 37 are low-friction slides that permit the vehicle user to tone (i.e., recline back with feet extended forward). The slides 37 may be mounted in any suitable manner and may be any suitable low-friction structure, such as but not limited to nylon-coated slides, ball bearing slides, or linear bearing slides. The slides 37 may be of the type, for example, that are commonly used as drawer slides, as shown in Figures 9 and 10. The frictional coefficient of the slides 37 should overcome the potential inertial force to allow the seating system 30 to return to the non-reclined condition.

[023] In a preferred embodiment of the invention, the primary guiding function is carried out by the slides 37. However, the low-friction guides 40 may be positioned beneath the inner seat tray 34 as well to provide an additional low-friction surface for

supporting the weight of the vehicle user. The bottom guides 40 may be any suitable low-friction material or configuration.

[024] The seat tray extension 38 is provided with one or more slots 42 that are oriented in a forward/rearward direction. Bolts, not shown, fit through the slots 42 in the seat tray extension 38 to enable it to be fixed at an appropriate position to accommodate the physical features of a particular vehicle user, and to enable adjustment as necessary for the growth of the vehicle user. Other fastening arrangements, not shown, can be used for attaching the seat tray extension 38 to the inner seat tray 34. It can be seen that the seat tray extension 38 is mounted on the inner seat tray 34 in an alterable manner that enables the seat tray extension 38 to be adjusted in the forward and rearward directions with respect to the inner seat tray 34.

[025] The seating shell base 32 has a bottom wall 46 and side walls 48, all of which can be made of molded plastic, aluminum sheet, or any other suitable material. The inner seat tray 34 is provided with a bottom tray surface 50 and opposed upwardly extending seat tray arms 52. Mounted to the seating shell base 32 is a folding seat back 56. The folding seat back 56 is comprised of a back plate 58 and seat back pivot arms 60, which are pivotally attached to the upwardly extending seat tray arms 52 at pivot points 62. Preferably, a nylon washer is inserted between the seat back pivot arms 60 and the seat tray arms 52. The pivotal mounting of the folding seat back 56 enables the seat back 56 to be folded forward into a relatively compact folded configuration, shown in Figure 5, that makes the vehicle 10 easier to transport when not occupied by the vehicle user. The seat back pivot points 62 are preferably positioned relatively high on the seat tray arms 52 to enable the seat back 56 to fold into a compact configuration. In a preferred embodiment of the invention, the pivot points 62 are positioned so that they coincide with the anatomic pivot point of the user's body for the greatest conformance to the user's body during the recline of the seat back 56.

[026] The folding seat back 56 is optionally provided with a seat back extension 66 that can be adapted with vertical slots 68 that enable the seat back extension 66 to be raised vertically with respect to the folding seat back 56 to accommodate the positioning needs of the vehicle user. A back cushion, not shown, can be attached to the seat back extension 66 for the comfort of the vehicle user. Further, a seat cushion, also not shown, can be used on the seat tray extension 38 for improved comfort of the user.

[027] As shown in Figures 5-7, at the rear of the seating system 30 is a back support bar 72. The rearward end 73 of the side walls 48 of the seating shell base 32 are provided with slots 74, and the ends of the back support bar 72 are connected to the seating shell base 32 by their insertion through the slots 74. Although a back support bar 72 is shown, it is to be understood that any other structural back support member, such as a link or a block, not shown, for connecting the seat back 56 to the seating shell base 32 can be used. Locking clamps 76 attached to the ends of the back support bar 72 secure the back support bar 72 to the seating shell base 32. The locking clamps 76 allow the back support bar 72 to be positioned at any vertical location along the slots 74. Other locking mechanisms, such as a wing nut, can be used for securing the back support bar 72 at a particular vertical location in the slots 74. The slots 74 are substantially vertical, which for purposes of the present invention means literally vertical or oriented at a slight angle to the vertical. Preferably the slots 74 are at an angle within the range of from about 5 degrees to about 20 degrees to the vertical. Although straight slots 74 are shown, curved slots, not shown, can also be used. The curved slots would change the geometry of the recline of the seat back 56 and the pivoting of the seat back 56 about the pivot points 62.

[028] The folding seat back 56 is connected to the back support bar 72 by means of a release block 78 that preferably has a concave or hook-shaped component 80 adapted to mate with or grasp the support bar 72 to form a releasable connection. When the release block 78 is engaged with the support bar 72, the folding seat back 56

is prevented from folding forward. The back support bar 72 may be provided with bar guides 82 which define a central portion 84 of the back support bar 72 which is engaged by the hook-shaped component 80 of the release block 78. The bar guides 82 help align the folding seat back 56. The release block 78 can be attached to the folding seat back 56 by any suitable means, such as, for example, a bracket 85. Preferably, the release block 78 is pivotally or slidably mounted so that it can be readily lifted up by hand, as shown in Figure 7. Optionally, a spring, not shown, can be provided to bias the release block 78 downwardly, requiring an upward force to release the connection with the support bar 72, and thereby providing an automatic locking of the seat back 56 in an unfolded condition. The release block 78 can be made of any material, such as nylon. The folding seat back 56 is preferably provided with a handle grip 88 that can be grasped to fold the seat back 56 forward. The release block 78 is preferably adapted with a concave lift handle 90 to enable the release block 78 and handle grip 88 to be grasped with one hand, as shown in Figure 7, for simultaneously releasing the release block 78 from the back support bar 72 and folding the seat back 56 forward. Although a release block 78 is shown to connect the seat back 56 with the back support bar 72, other seat engaging mechanisms capable of being selectively actuated can also be used.

[029] The slots 74 in the seating shell base 32 are oriented at a rearward angle to the vertical so that as the back support bar 72 is lowered in the slots 74, from the upright position shown in Figure 2 to the recline position shown in Figure 3, the support bar 72 will be moved forward and downwardly. Since the folding seat back 56 is normally connected to the back support bar 72 through the release block 78, the seat back 56 will be rotated as the back support bar 72 is moved down in the slots 74. This has the effect of moving the inner seat tray 34 forward because of the hinged connection at the pivot points 62 between the seat back pivot arms 60 and the seat tray arms 52. The forward movement of the inner seat tray 34 during the recline of the seat back 56 moves the user's body forward, thereby counteracting the tendency of the center of gravity to move rearward with the recline of the seat back 56. The geometry

of the various components of the seating system 30 enables the inner seat tray 34 to move forward at approximately the same rate that the center of gravity would otherwise move rearward with the recline of the seat back 56 so that there is very little forward or rearward movement of the center of gravity of the vehicle or of the user of the vehicle. Preferably, the movement of the center of gravity is less than a total of one inch of forward and rearward movement.

[030] The attachment of the seating shell base 32 to the base 12 can be by bolts or any other suitable attachment. However, in a preferred embodiment of the invention, the seating shell base 32 is provided with a pivot post 96 and guide pin 98, as shown in Figure 2. The frame 18 of the base 12 can include a tilt-in-space block 100, as shown in Figure 8. The tilt-in-space block 100 may include a plurality of apertures or cavities 104 arranged in an arc-like pattern on the side wall 106 of the tilt-in-space block 100. The tilt-in-space block 100 also includes a guide slot 108. The guide slot 108 is configured to receive the pivot post 96 and the guide pin 98. Preferably, the guide slot 108 is substantially T-shaped with a generally straight upper portion 110 and an arc-shaped lower portion 112. At the uppermost portion of the guide slot 108 is the pivot post cradle 114 where the pivot post 96 is seated.

[031] To install the seating shell base 32 onto the base 12 after being completely removed from the base 12, the tilt-in-space block pivot post 96 and a guide pin 98 on each side of the seating shell base 32 are aligned with the guide slot 108. Then, the guide pin 98 is guided into the upper portion 110 of the guide slot 108 until the guide pin 98 enters the lower portion 112 of the guide slot 108, and the pivot post 96 is seated at the pivot post cradle 114 at the top of the guide slot 108. Latch pins, not shown, can be mounted on the seating shell base 32 for selective engagement with the apertures 104 to set the desired angle of the seating shell base 32 with respect to the base 12. The structure and operation of the tilt-in-space block mounting system is explained in greater detail in U.S. Patent No. 6,086,086, which is hereby incorporated by reference in its entirety.

[032] Although not shown, the vehicle user is held into and against the seating system 30. This can be accomplished with any suitable restraint. For example, a conventional lap belt and harness can be adapted for use with the seating system 30 for holding the user in the seating system 30. The seating system 30 permits the vehicle user to tone even when held into and against the seating system 30. Toning most often occurs when the vehicle user does not have motor control. During toning, the user's muscles tense and the user straightens out. The restraint holds the user integral with the seating system 30. But for the movement of the seating system 30, the seating system 30 would be hard on the user and the user would likewise be hard on, or abuse, the seating system 30.

[033] It should be noted that the seat tray extension 38 remains in a single plane to allow changes in the hip angle of the user through horizontal movement of the seat tray extension 38. As the seat tray extension 38 slides forward, the seat back extension 66 reclines and the leg support 22 pivots automatically at the knee joint of the user. This movement allows the user to tone into full extension without placing undue stress on the mechanical components of the seating system 30. When the user relaxes tone, the seating system 30 is subject to return to the non-reclined condition, with the seat tray extension 38 and the seat back extension 66 in a relationship that is preferably substantially 90 degrees relative to one another. Since the pivot points 62, 64 of the seating system 30 approximate the anatomical pivot points of the user's body, dynamic action occurs without introducing shear between the seat tray extension 38 or the seat back extension 66 and the user's body. In addition, the length of the leg support 22 does not have to change as the leg support 22 swings away from and towards the seating system 30. During movement of the seating system 30, the seating components that support the user are constantly in contact with the user to maintain alignment of the user about a lateral center line or mid-line of the seating system 30. Since all the pivot points of the seating system 30 are based upon the pivot points of the user, the seating components maintain their relationship with the user. The seating system 30 also has the ability to lock into a neutral body position when it

is desirable to prevent the user from moving, for example, for safety reasons, such as when transporting the user in a vehicle. The seating system 30 can also be adjusted in different tilt-in-space positions. The locking clamp 76 allows the seating system 30 to be secured in any desired hip angle position, providing the benefit of the reclining function.

[034] According to a preferred embodiment of the invention the seating system 30 may be provided with a biasing element 120 for automatically returning the seating system 30 back to the non-reclined condition when the user relaxes tone. The biasing element 120 should overcome friction in the slide 37 against the weight of the user, and with possible assistance from the user, to return the seating system 30 back to the non-reclined condition.

[035] The biasing element 120 may include but is not limited to one or more springs, including helical springs, fluid springs, such as gas springs, or a combination thereof. In the embodiment illustrated in Figures 11 and 12, a helical spring and a gas spring are used in combination.

[036] The biasing element 120 may by connected relative to the seating shell base 32 and the inner seat tray 34. This may be accomplished in any manner. For example, one end of the biasing element 120 may be connected to a clevis 124 on the seating shell base 32 and the other end of the biasing element 120 may be connected to a clevis, not shown, on the inner seat tray 34. During forward movement of the inner seat tray 34, as the user tones, the biasing element 120 stores energy to automatically move the inner seat tray 34 rearward when the user relaxes tone.

[037] A biasing element 120 according to the preferred invention may have a dampening effect. That is to say, the biasing element may function to dampen the effect of the movement of the seating system 30 to the reclined condition, the non-reclined condition, or both. In the most preferred embodiment of the invention, the

biasing element 120 dampens the effect of the movement of the seating system 30 to the non-reclined condition.

[038] It should be appreciated that the biasing element 120 may be adjustable so that the resistance or force of the biasing element 120 or movement of the seat tray extension 38 can be adjusted. This can be done in any suitable manner.

[039] Although the invention has been described thus far as being connected with a manually operated vehicle, it is to be understood that the invention can be used with power vehicles, as well as other seating devices such as swings, and stationary seating devices, such as indoor bases.

[040] The principle and mode of operation of this invention have been explained and illustrated in its preferred embodiment. However, it must be understood that this invention may be practiced otherwise than as specifically explained and illustrated without departing from its spirit or scope.